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Boundary value problem of nonsymmetrical deformation of the cylindrical vessel with liquid in the thermal field

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Abstract

© PNRPU. We framed a precise solution of the nonsymmetrical boundary value problem of the elasticity theory for a cylindrical vessel with liquid placed in the thermal field. The thermoelastic problem is unlinked, i.e. at first we solve the thermal conductivity equation, and then the linear problem of the elasticity theory for a circular cylinder in displacements. It should be noted that until the present time there were no precise solutions of nonsymmetrical problems of the elasticity theory in the cylindrical coordinate system with a consideration of the thermal field. It is explained by the complexity of the system of resolvent equations, such as high order, variable coefficients. The authors of the article managed to form integrable combinations of resolvent equations in this work, at first by taking no account and then considering the thermal fields. For this purpose an additional equation related to a volumetric deformation was introduced into the system of resolvent equations instead of the relator connecting the volumetric deformation with the movement of the cylinder points. When we took into account the heat conduction equation, we managed to gain the equation which had been obtained earlier without the consideration of the thermal elements. As a result, the problem was brought to a successive solution of each equation separately. Since the additional equation was obtained by the derivation of the rest of the equations, the order of the resolvent equations system became higher which resulted in "excess" constants of the integration. The authors proved that the use of the replaced correlation between the volumetric deformation and displacements as an additional condition eliminated this disadvantage. We formed a precise solution of the boundary value problem for the cylindrical vessel with liquid upon the condition of the linear dependence of temperature and displacements of the cylinder along its axis. The numerical example was considered where the temperature of the external side area of the cylinder is changed in the circumferential direction.

Keywords

Displacements, Elasticity theory, Temperature, Unlinked problem

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